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The Mysore Agricultural Journal

(The Organ of the Mysore Agricultural and Experimental Union)

Vol. XXVI] Published January 1951 [Nos. 3 & 4

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HEALTH ORGANISATION IN MANDYA DISTRICT

THE ECONOMIC BASIS OF COTTAGE AND SMALL INDUSTRIES

HINTS ON SAFE PRESERVATION OF SEED AND FOODGRAINS

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[*The authors of the articles are severally responsible for the facts given and opinions expressed in the articles.*]

EDITORIAL

Due to unavoidable circumstances we were forced to stop the publication of the English Journal of our Union—*The Mysore Agricultural Journal.* We are glad to announce that we are able to continue it once again. Nearly three years have elapsed since the last number was issued. We are thankful to all our friends who kept up their contacts with us during this period; and with the renewal of the publication we look forward to an ever-growing cordiality.

The problem of food production has held the attention of the public during this period as painfully as in the preceding years; and intensive cropping has been advocated in all its aspects. Quite naturally, consideration had to be given to alternative food crops, in order to attain a measure of self-sufficiency. One of the crops in this category on which attention has been focussed is Tapioca. Attempts are being made to extend the cultivation of this crop and popularise its products as articles of consumption.

Lift irrigation schemes have been set on foot. Desilting and restoration of minor tanks have been taken up. Pumps, both electrically driven and those driven by diesel oil engines, are being distributed all over the State. Soil Survey work has been in progress under the two major irrigation projects.

Tree Planting is another item of work on which much propaganda has been made. Planting Festivals have been conducted and the public have been sufficiently educated to appreciate the necessity of afforestation in order to control the climate of the country and prevent soil erosion.

Among the factors of crop planning, mention must be made of recent expansion in the area of cotton. The deficiency of clothing in the country was only next to the deficiency of food. During the earlier years of the decade stress was laid on increasing mainly the area under food crops, some of the cotton area being given over to this, to cover the deficiency. It was not long before the problem of cotton also began to be felt. During the expansion in the area of this crop this time attention has been given to finer and better varieties with longer staple length, evolved by the Department.

Co-operative enterprises have developed considerably. A network of Multipurpose Co-operative Societies at Taluk and Village levels has been established. Marketing Societies have been constituted. Co-operative organisations for commodities like cotton have emerged; and regulated markets have come into being in a few important centres. A line of development that is more closely connected with agriculture is the emergence of co-operative farming. A few such farms are in working and their progress is being watched.

It is hoped that in future this journal will be published uninterruptedly; and with this fond hope we greet our co-operators and well-wishers.

K. H. S.

HEALTH ORGANIZATION IN MANDYA DISTRICT

By S. Seshagiri Rao, *District Health Officer*

History : Mandya District with a population of 6,35,588 distributed in 1,489 villages is situated about 30 miles to the north of Mysore City. The District was dry prior to the excavation of the Visweswaraiah Canal and the ryots depended on seasonal rains for most of their agriculture. The crops usually grown were ragi, jola and rice below the tanks. Some parts of Mandya District were served with channels taken off from the Hemavati and the Cauvery rivers; but the area commanded by these channels was comparatively small in extent. Paddy fields were confined to the areas served by these channels.

It was conceived in the year 1917 that a dam across the Cauvery near Kannambadi village would bring relief to the Mandya District by facilitating irrigation of more than a lakh of acres. The construction of the dam was begun in the year 1919 and was completed in the year 1931. The dam was so designed as to impound enough water to tide over periods of drought as well as to provide for perennial irrigation. The designers knew that the incidence of malaria would rise when irrigation was commenced in this region and as a precautionary measure, suggested the triennial rotation of crops—sugarcane, paddy and dry or semi-dry crops—and the 'Block System' of allotting fields for wet and dry cultivation. This is in contrast to the system of cropping under the high-level and low-level channels, where water is allowed to flow in the channels for six months in the year and a single crop is harvested.

Water, mosquito and malaria go together. This has been well demonstrated in Mandya area. Though more than 150 tanks existed in the present irrigated area during the pre-canal days, malaria was not rampant. The amount of malaria present, as judged by the spleen rate, an index of the prevalence of malaria, the whole of Mandya was classified as healthy. With the advent of the Visweswaraiah Canal the conditions in the villages changed entirely. The tanks which previously depended only on rains began to be always full and overflowing, the land which was dry became water-logged, the subsoil water previously full 50 ft. underground rose to within 5 ft. from the ground level and on account of the excessive moisture in the ground, all the valleys were overgrown with thick weeds. Ideal conditions for mosquitoes to breed were created. Humidity rose from 60 per cent. to 95 per cent. This high humidity favoured the longevity of the mosquito and the

development of the malarial parasites in the mosquito. Favourable conditions for the spread of malaria being present, the disease took no time to break out in an epidemic form. Almost the whole population suffered from a severe type of malaria and the death toll was heavy. Villages which were flourishing became depopulated, the number of deaths was many times the number of births and it was said that women did not even conceive and those that conceived had abortions. The conditions were appalling.

In the year 1935, the Government started a Malaria Control Unit in Mandya, the object of which was three-fold.

1. To distribute quinine.
2. To spray pyrethrum kerosene mixture biweekly to destroy adult mosquitoes.
3. To carry on experiments with Paris Green to assess the value of Paris Green in the control of rural malaria.

Interesting data were collected. It was proved that Paris Green as a larvicide in the control of malaria in rural areas was a failure. The distribution of quinine had some effect in reducing the incidence of malaria but the result was not as satisfactory as it should be due to various reasons.

A special committee was constituted in the year 1941 consisting of a Health Officer, an Engineer and a Revenue Officer to conduct a survey and suggest the measures necessary to control malaria. This Malaria Committee visited nearly 500 villages during the course of two years and the specific recommendations for each village are embodied in their reports. The following are the proposals suggested in general:

1. Depletion of tanks.
2. Creation of a Dry Belt of 2 furlongs round each village.
3. Grading and canalisation of valleys and draining of marshy lands.
4. Deviation of channels and lining of channels, if they cannot be deviated beyond the 2-furlong zone.
5. Shifting of villages wherever it is economical. This usually applied to villages consisting of 20 houses or less.

Health Organization : In the year 1942, the Malaria Control Unit was reorganized with sufficient staff to undertake regular and systematic spraying of all houses in 67 villages of Mandya Taluk, once in 5 days. The Government sanctioned 35 lakhs of rupees for the anti-malaria engineering works to be undertaken in three stages, the first stage costing Rs. 8 lakhs required to deplete the tanks, create dry belts and shift villages, the second stage costing Rs. 15 lakhs for canalising valleys, depleting tanks and shifting villages and the third stage costing Rs. 12 lakhs to complete the works.

The combined effect of spraying and anti-malaria engineering works was apparent in a year or two. Many of the houses which used to be damp were dry and people could comfortably sleep on the floor, there was no stagnation of water round the village, the mosquito nuisance was considerably less and the prevalence of malaria was reduced. The complexion of the people changed, pale faces turning red. There was more life in the villages, people were happier and were able to go in pursuit of their agricultural operations. The mortality rate dropped, the haemoglobin index had gone up, the spleen rate came down, and the pregnancies resulted in the birth of live babies. The activities of the Health Unit were extended from 67 villages in 1942 to 210 in 1942, to 362 in 1944, to 428 in 1946 and 557 in 1948.

The 'Bhore Committee' after extensive survey of Medical and Public Health Services available to the people in India opined that in an agricultural country like ours, the best way of providing medical assistance and improving the health of the people is to combine curative and preventive medicine. They recommended the formation of Health Units where these two branches of science are combined; and in order to afford facilities to the maximum extent possible, the Health Units are organized on the basis of the population, the type of country and the transport facilities available. The Health Units are classified into three categories, Primary, Secondary and District Units. The Primary Unit consists of a rural dispensary manned by a qualified Medical Officer assisted by Public Health Nurses, Midwives, Health Inspectors and Fieldmen and is intended to serve a population of 15,000 to 20,000. A Midwife serves a population of 5,000 and a Public Health Nurse is placed in charge of 3 midwives. All the personnel are under the direction of the Medical Officer of the Primary Centre. The Primary Centres, 4 or 5 as is convenient, are grouped into a Secondary Centre, where a fairly big-sized hospital with beds is established. The Medical Officer of this institution supervises and directs the work of the Primary Centres. He is assisted by a staff qualified in various branches of Medicine and Public Health. Patients who cannot be treated at the Primary Centre and require hospitalisation are sent to this hospital. The population served by a Secondary Centre varies from 60,000 to 1,00,000.

A number of Secondary Centres are grouped into a District Unit where a hospital with 500 beds equipped with necessary appliances is provided. The services of specialists are available at this level. Cases which require the attention of a specialist are sent from the Secondary Centres. The Medical Officer of the District is responsible for the organization, and proper working of all the units in the District.

The Government of Mysore are pioneers in implementing the recommendation of the Bhore Committee. The existence of a number

of rural dispensaries was taken advantage of and a number of Primary Centres were started in Mandya District. A few dispensaries in addition were opened in convenient places. The Primary Centres in each taluk are grouped into a Secondary Centre and a Medical Officer posted in charge. There are 20 Primary Centres grouped into 4 Secondary Centres at present; these are placed in charge of Medical Officers of Health. The existing Primary Centres are serving a population of 2,94,466.

The work of the centres consists of :

1. Surveying villages as to the prevalence of malaria in them and taking up measures to control the disease.
2. Assessing the value of the anti-malarial measures adopted by collecting morbidity statistics, collecting larvae and adult mosquitoes and identifying them, conducting spleen surveys twice a year, in the month of April and October, and estimating the Haemoglobin index.
3. Treating all cases including malaria.
4. Holding weekly clinics in 2 or 3 places in each Centre with the object of examining ante-natals, post-natals and infants. At the same time, medicine is given to patients who cannot attend the dispensary.
5. Controlling epidemic diseases.
6. Collecting vital statistics.
7. Providing the services of a midwife at the time of child-birth.
8. Conducting pre-school work.
9. Conducting School Health work.
10. Undertaking several sanitation in villages, *i.e.*, improving the existing houses by introducing windows, introducing latrines, improving the flooring, separating the dwelling quarters from the cattlesheds, filling pits, removing manure pits, etc.
11. Carrying on propaganda.

The main problem in the greater part of Mandya District is malaria. Malaria is a disease which can be eradicated by adopting certain simple measures provided the people are co-operative and responsive to the advice of the Health Department. That the measures adopted in this District have been beneficial is proved by the fact that the average enlarged spleen, which is an index of the prevalence of malaria, in a group of 67 villages which were originally taken up when the anti-malarial measures were started in 1942, has come down from 3·2 to 2·1 within these few years. Further a study of the different degrees of enlarged spleen indicates that there is a shift to the left showing thereby that the chronic enlargements of spleen are getting reduced.

Distribution of enlarged spleen in respect of 67 Villages of Health Unit, Mandya

Month	Total No. examined	Negative	Total Positive	P.	1	2	3	4	Average enlarged spleen	Spleen Rate	Birth Rate	Death Rate	Remarks
April 1942 ..	3051	563	2486	178	606	545	885	372	3·18	81·5	15·7	22·7	
Oct. 1942 ..	2876	747	2129	178	610	480	726	135	3·01	74·2			
March 1943 ..	2910	923	1987	406	660	538	345	18	2·4	68·2	34·4	25·7	
Nov. 1943 ..	3081	967	2114	596	606	652	206	54	2·28	68·6			
May 1944 ..	3136	1258	1878	296	507	566	460	50	2·7	59·9	24·8	21·2	
June 1945 ..	2895	885	2010	424	506	465	413	203	2·73	16·6	18·0	18·3	
Nov. 1945 ..	3185	150	2170	406	714	504	442	104	2·6	68·1			
May 1946 ..	3158	982	2176	640	653	402	330	151	2·4	68·6	19·1	17·3	
Oct. 1946 ..	3353	1481	1872	416	746	391	229	90	2·38	55·8			
April 1947 ..	3423	1728	1695	583	547	304	177	84	2·19	49·5	26·0	17·0	
Oct. 1947 ..	3423	1811	1612	593	579	221	170	49	2·07	47·4			
April 1948 ..	2236	934	1302	353	543	246	112	28	2·2	58·2	28·7	18·9	
Oct. 1948 ..	2300	1066	1234	192	518	348	157	19	2·4	53·6			
April 1949 ..	3277	1881	1396	409	557	264	150	16	2·1	42·6	28·7	25·7	
Oct. 1949 ..	3636	2117	1519	536	438	312	180	53	2·19	41·8			

It is also stated that extensive areas which were lying fallow have recently been brought under cultivation, an evidence of improvement of the health conditions. Before the anti-malarial measures were adopted, the birth rate was low and the death rate high. The birth rate is gradually rising with a corresponding reduction in the death rate. The measures adopted would have been even more effective if there had been better co-operation from the people.

Meanwhile the following is a sample list of hints transmitted by the health organizations to the rural population for their guidance:

1. The village reserve should not be brought under wet cultivation.
2. All pits in and around the village should be filled with earth.
3. Any small collection of water is a source of mosquito breeding. Hence old pits, shells of cocoanuts, old tins and all odd pieces of thrown-out utensils which are likely to collect water should be destroyed or buried.
4. Every case of malaria must be treated thoroughly. Consult the nearest doctor, who will administer *paludrine* or any anti-malarial drug available.
5. Permit the Health staff to spray the houses with D.D.T. or pyrethrum extract.
6. Every expectant mother should consult a midwife periodically.
7. Do not forget to utilise the services of a midwife at the time of child-birth.
8. Remove the case to the hospital if there is the least complication during child-birth.
9. Remove manure heaps away from the village.
10. Introduce windows in houses to admit light.
11. Separate the cattle sheds from dwelling portions of the houses.
12. Avoid promiscuous defaecation. A latrine should be constructed in each house.

It cannot be said that all the objects of the Health Department have been achieved in full, but the people have come to realise the utility of this organization and a sort of sanitary conscience is roused in them. The result is, the demand for the establishment of more Health Units is increasing.

THE ECONOMIC BASIS OF COTTAGE AND SMALL INDUSTRIES IN INDIA

By B. A. Balachowdiah, *Lecturer in Agricultural Economics, Agricultural College, Hebbal, Bangalore*

Cottage industries in India were once in a flourishing condition and their products were demanded not only within the country but they had earned high reputation in foreign markets also. But gradually, due to several causes, there has been a general decay of these industries and today we find that some of them are completely extinct, while some are struggling very hard to survive. For example, in Mysore State, due to introduction of power-driven machinery, oil-pressing and glass bangle making have practically disappeared. Hand-loom weaving, sericulture and metal working industry are being threatened again and again by cheap machine-made articles. The Census Reports of 1931 and 1941 indicate that cottage industries, on the whole, in Mysore State are gradually declining. There were 48,000 families in 1931 engaged in such industries and the total population supported was more than 2·68 lakhs whereas in 1941 the number of families was reduced to 41,487 and the number of persons supported to 2·11 lakhs. However, artistic industries like jewellery, ivory carving, carving in wood and inlay work, where the personal skill and attention of the worker is essential and where mechanisation is not possible, have been able to survive without any difficulty. In recent years, however, the Governments at the Centre and in the States have been keenly concerned with the problems of revival and development of cottage and small-scale industries in the country.

The importance of cottage and small industries to the economy of our country, which is predominantly agricultural, is very great. Even in highly industrialised countries, small industries have a significant place. It is estimated that in the United Kingdom, units employing between 5 and 30 persons account for 29 per cent. of the employment and 19 per cent. of the output. In Japan, in 1930 the number of persons engaged in workshops employing less than 5 persons was 23·5 lakhs or 53 per cent. of the total industrial workers. In India, also, it is an economic necessity to develop cottage industries. Since the beginning of this century, large-scale industrialisation has been rapidly progressing in this country. The expectation that industrialisation would solve the problem of unemployment has not been fulfilled. We are self-sufficient in regard to sugar, cement and matches

and we produce most of our requirements of cotton, cloth, iron and steel. It has been estimated that even if all our requirements are manufactured, organised industrial establishments as a whole in the country may employ about two million persons. But the number of unemployed runs into several millions and only a small fraction of these may be expected to be absorbed by manufacturing industries. Under-employment and unemployment are particularly prevalent among the agricultural population and as observed by the First Fiscal Commission of the Republic of India in their recent report, no objective of economic policy that does not attempt to deal comprehensively with the chronic problems of unemployment and under-employment in the agricultural sector of the country's economy will achieve the basic purpose of raising the standard of living of the people. The only remedy to this economic malady is the development of cottage and small industries.

In recent decades, there has been a gradual increase in the pressure of population on agricultural land in the country. This has been the result of the natural growth of population and of the absence of alternative openings for adequate employment. About 70 per cent. of the population is forced to find its living from agriculture, while the corresponding proportion of population employed in agriculture in the U.S.A. is about 25 per cent., in the U.K. 5 per cent. and the average in other fairly well-to-do countries is about 33 per cent. In Mysore State persons earning their livelihood by industry, trade and transport were fewer in 1941 than in 1931, whereas persons dependant on agriculture were more. Land resources have not increased proportionately, considering the country as a whole. The cultivated area has increased by 15 per cent. whereas the population has increased by 34 per cent. As has been pointed out earlier, the scope for increasing employment by large-scale industrialisation is very limited and the alternative lies in the promotion of cottage and small-scale industries.

Further, agriculture is largely a seasonal occupation and the cultivator does not find work on his farm for several months in the year. Consequently the income of the Indian ryot from land is too low to enable him to maintain a standard of living necessary to give him the minimum comforts of life and to keep him efficient for work. The Royal Commission on Agriculture in India have summed up the position of Indian Agriculture in the following words: "To a very great extent the cultivator in India labours not for profit, nor for a net return but for a subsistence." This condition invariably leads him to debt from which, very often, he is never able to extricate himself. The economic condition of the landless agricultural labourer is more deplorable than that of the ryot. Invariably he spends more than what

he earns. The truth that he does not find adequate employment in agriculture is proved by the fact that he earns only about 55 per cent. of his annual income by working on agricultural land for wages. Employment for these underemployed in cottage industries will improve their economic condition by giving them additional purchasing power and this increased purchasing power will in its turn promote production and employment in other industries, small and large. The economic system will then work satisfactorily because then it will provide for an adequate production of goods and a proper diffusion of spending power in the country.

There are some problems which must be solved for creating favourable conditions for the development of cottage industries. These are problems of securing raw material required for such industries at reasonable prices, finance and marketing of their products. We have good lessons to learn, in this regard, from countries like Japan and Germany. An interesting feature of Japanese cottage industries is that the small producers combine and form associations called "Kogyoo Kumiai" which provide them with raw material, finance, technical advice and arrange for marketing of their products. In India also, as the small industries form an organic part of the economic structure of the country, the small producers must be encouraged to form similar associations to help themselves by observing the cardinal principle of co-operation "Each for all, all for each". Co-operation is merely self-help rendered effective by organisation. Like the agriculturist, the cottage worker also approaches the money-lender for finance and in return falls a victim to exploitation. The decay of the Dacca Muslin Industry, a typical cottage industry of India the products of which had made a name in Indian and foreign markets, has been attributed to the excessive and unscrupulous exploitation of those weavers by the middle-men money-lenders who financed them. The position of the cotton, silk and woollen weaver in this country is much similar to this. Since the workers do not receive adequate reward for their labour, being gulled by the profiteering intermediaries, their incentive for work is killed and any work which has no proper incentive behind it is bound to create its own means of decay. In the apt words of Malthus, "From the want of a proper distribution of the actual produce, adequate motives are not furnished to continue production". Hence the middleman must be eliminated both in the production and marketing of the products of cottage industries before such industries are enabled to thrive. The small size and scattered nature of these industries require formation of co-operative societies for solving their problems. The State should come forward to help starting and developing such societies.

The Government of India recently deputed a committee of officers to Japan to study the organisation and working of small industries there and to advise on the possibilities of adopting similar methods in India. Two Japanese experts are already in India now, on invitation by the Government of India, to offer advice on the development of cottage industries. The All-India Village Industries Association, formed under the advice and guidance of Mahatma Gandhi is conducting research on cottage industries development and maintains a first class museum of village industries and of handcrafts from India and outside. This museum serves to give publicity to the products of small industries. It is also the concern of the State to find out new markets for these products and to set up an organisation which may be entrusted with the task of studying the nature of demand and tastes of the consumers and of supplying necessary information to the cottage worker to enable him to produce articles which can serve the needs of the market as fully as possible. The Export Promotion Committee, in their report have stated that the products of some Indian cottage industries like brass-work, wood and ivory carving and certain types of jewellery are in good demand in U.S.A. and some other foreign markets. The products of these industries must be given adequate publicity by displaying them in exhibitions within the country as well as in International Exhibitions. The fact that the State has a large part to play in promoting the development of cottage and small-scale industries has been emphasized by the National Planning Committee under the Chairmanship of Pandit Jawaharlal Nehru in their Report on "Rural and Cottage Industries", in the following words: "The Committee attaches the greatest importance to the immediate creation of an All-India Cottage Industries Board to be developed on the same lines as the Indian Council of Agricultural Research, for organising, promoting and helping cottage industries and small-scale industries. This Board should study the Provincial Plans and make recommendations for their co-ordination and further development and for the administration of the funds which may be placed at its disposal by the Government of India." The Government of Mysore have a new policy for the development of cottage industries in the State in implementing the Sir M. Visvesvaraya Scheme of Rural Industrialisation. It is confidently hoped that this scheme prepared by Sir M. Visvesvaraya, one of the makers of Modern Mysore, will bear ample fruit soon.

Thus, as emphasized by Mahatma Gandhi repeatedly, "salvation of India lies in the cottages". Instead of dragging the rural population to the urban areas for employing them in factories, small industries must be taken to their doors and they must be retained in their rural homes. To avoid competition with large-scale industries, the various processes of an organised industry may be spread among the cottages.

Then, small industries and big industries will help and promote the development of each other, rural indebtedness will be liquidated, a smiling countryside will be created and the national income will be enormously increased. In the words of an eminent economist, "The working agricultural population of India has much traditional skill and knowledge and given the chance it can give as good an account of itself as peasantry anywhere, provided it can find a rational basis for its work and livelihood".

RURAL ELECTRIFICATION IN MYSORE

(*By courtesy of the Chief Electrical Engineer*)

The number of Villages served by power in each District in Mysore State are as follows :

Bangalore	..	199
Kolar	..	93
Tumkur	..	15
Mysore	..	30
Mandya	..	37
Chitaldrug	..	18
Hassan	..	14
Chickmagalur	..	9
Shimoga	..	27

There are at present 1,776 Irrigation Pump sets working in the State for pumping water from wells for agricultural purposes.

The following details will show the programme of Rural Electrification :

1. 52 Taluks have been surveyed for power supply.
2. 601 Villages have been surveyed for electrification in the above Taluks.
3. 114 Estimates for the electrification of about 438 Villages are prepared for Rs. 2,92,04,585.
4. 28 Estimates for the electrification of about 52 Villages amounting to Rs. 61,81,320 is under check and scrutiny.
5. Load survey for another 35 Taluks with 537 Villages is under the active consideration of the Department and progress in this line for preparation of estimates is being made every day and estimates for these villages when prepared and finalised are being sent to Government for sanction.

The following are the rates per unit of power supply to Irrigation Pumps :

(*i*) Pumps used for irrigating Food Crops—Six pies per unit.

(*ii*) Pumps used for growing Commercial Crops—One Anna per unit.

The following are the concessions offered to the Ryots by the Electrical Department :

1. No minimum guaranteed return on the capital invested by the Department with respect of power supply to I.P. sets is

required to be paid. But for power supply to other purposes, a minimum guaranteed return on the capital investment is insisted upon.

2. The rate of supply charged at six pies per unit for irrigation pump sets is the lowest compared to that of power supply to any other purpose.
3. A monthly minimum of eight annas per H.P. in the case of pumps used for Food Crops and a minimum of Rs. 2 per H.P. in the case of pumps used for Commercial Crops are levied from the consumers of electricity for agricultural purposes. This "Horsepower Minimum" as it is called is also the lowest among the tariff in force for electric supply to various purposes.
4. Only in the case of power supply to I.P. sets the Department extends at Government expense, the supply line up to the pump house of the Ryot, however far it may be from the existing power lines, thus minimising the initial investment by the consumer. After service is turned on, it also gives him such technical advice as may be required by him for the efficient working of the pump set.
5. Of the various works taken up by the Department, power supply to Irrigation Pump sets are assigned the top priority and the work of running the lines and installing the transformers are executed at the earliest possible time provided sufficient finance and materials are available.
6. The Department has been placing orders from time to time for pump sets of good quality and keeping them in stock for the use of the consumers who may want to buy them from the Department. The consumers who buy pumps from the Department are therefore guaranteed good pump sets. In addition, the agriculturist is also given the advantage, if so required by him, of payment for the pump sets in easy instalments under "Hire Purchase" system.

With the use of electricity for agricultural purposes the villages on the route and round about progressively make use of the supply for domestic lighting, street lights, home industries, etc., thus effecting an all-round improvement both from the point of view of æsthetics as well as from that of utility, like sanitation, industrialisation, domestic economy, etc. Provision of radio sets at every electrified village has not only afforded entertainment to the village folk but also has been of immense educative value apart from the link established between the village and the outside world. In addition to the above advantages, rural electrification has to some extent lessened the

unhealthy migration of rural population and retained it incidentally for the very essential purpose of growing more food crops.

This is a request to the agriculturist. He should have a good working knowledge about the care and maintenance of the motor as well as the pump set. The motor in particular should be kept clean and dry. Periodical cleaning of the pump set is necessary to increase the life of the pump set. In case of any trouble he must get into the habit of approaching the nearest Departmental authority for advice, who will only be too glad to render every permissible assistance.

STUDY OF WEEDS ON OUR FARM LANDS

By H. C. Govindu, *Lecturer in Botany, Agricultural College, Hebbal*

Unwanted species of plants growing and competing for space and nutrition in places where something else is cropped, are usually construed as weeds. In a general sense, plants growing in uncultivated waste lands are also called weeds, though they do not interfere with the crop plants. While most of the weeds are indigenous, there are several exotic plant species, which having got introduced, have established themselves permanently and form an important constituent of the local flora. As examples of these unwanted guests on our farm lands, we may quote *Waltheria, Argemone, Ageratum, Cosmos, Erechites* which have been introduced from America.

When one sees the rapidity with which the weeds crop up in the farm lands, one cannot escape the feeling that if crop plants could grow as fast and as luxuriantly as the weeds, there would be no food shortage in the world. It becomes apparent that the profuse growth the weeds have made is only at the cost of the crop plants competing with them for space, soil nutrients and light. Weed control is therefore an important operation in successful farming and has been achieved with different degrees of success in each country. In the western countries, the study of weed control has been developed on a scientific basis. The method of propagation, dispersal and persistence of the various weeds have been thoroughly studied and control measures by mechanical, biological or chemical means have been devised. Especially in the United States, the control of weeds by chemical means has become an established farm practice. By using different concentrations of the hormone compounds, popularly known as 2, 4-D, it has been possible to eradicate the weeds without affecting the crop plant. In a field of alfalfa (*lucerne*) the dandelion gets completely eradicated when a definite concentration of 2, 4-D is sprayed, while doing no damage to alfalfa. Miles and miles of irrigation streams have been cleared of *Eichhornia crassipes* (Water hyacinth) by spraying with 2, 4-D. However, with the present economic situation in the villages in India, our farmers could hardly think of employing such methods of weed control, though spectacular and efficient. Some studies on the weeds have been carried out in India; in Mysore the work in this regard has been little and hence it was felt that some studies should be initiated in this important subject. Preliminary studies have been made by the author on the classification of the important weeds in

dry and wet lands as well as our pasture lands. Studies on the phenological data, ecological affinities, seed production and dissemination and vegetative reproduction of some of the weeds of major importance in our farm lands in Mysore are also in progress. In this short note an account of the weed flora occurring in the dry and wet lands in the Hebbal Farm, Bangalore, where the preliminary work was started, is presented. With minor variations, the weed flora in the Hebbal Farm is typical of the farm lands round about Bangalore.

The following are the important dry land crops:—

Grain crops : Ragi, Jola, Sajje and Navane.

Oilseeds : Groundnut, Sesame, Castor and Niger.

Others: Cotton and most of the pulses.

Dry Land Weeds : *Acanthospermum hispidum* DC., *Anagallis arvensis* L., *Argemone mexicana* L., *Blainvillea rhomboidea* Cass., *Borreria hispida* K. Sch., *B. stricta* K. Sch., *Bulbostylis barbata* Kunth., *Celosia argentea* L., *Cephalostigma Schimperi* Hochst., *Cleome monophylla* L., *Commelina benghalensis* L., *Crotalaria bifaria* L., *Cynodon Dactylon* Pers., *Cyperus castaneus* Willd., *C. rotundus* L., *Digera arvensis* Forsk., *Digitaria marginata* Link., var. *fimbriata* Stapf., *Emilia sonchifolia* DC., *Eragrostis riparia* Nees., *Euphorbia hirta* L., *Evolvulus alsinoides*, L., *Fimbristylis dichotoma* Vahl., *Gomphrena decumbens* Jacq., *Hackelochloa granularis* O. Ktz., *Heliotropium scabrum* Retz., *Ionidium suffruticosum* Ging., *Lagasca mollis* Cav., *Leucas aspera* Spr., *Mollugo disticha* Ser., *Ocimum adscendens* Willd., *O. canum* Sims., *Oldenlandia corymbosa* L., *O. umbellata* L., *Perotis indica* O. Ktz., *Phyllanthus niruri* L., *Polycarpaea corymbosa* Lam., *Polygala chinensis* L., *Polygonum plebejum* R. Br., *Rothia trifoliata* Pers., *Trachys muricata* Steud., *Trichodesma indicum* R. Br., *Tridax procumbens* L., and *Vicoa indica* DC.

Wet Land Weeds : *Alternanthera triandra* Lam., *Asteracantha longifolia* Nees., *Bacopa Monneri* (L) Pennell., *Centella asiatica* Urb., *Corchorus olitorius* L., *Cyanotis axillaris* R. S., *Cyperus difformis* L., *C. Iria* L., *C. tenuispica* Steud., *Dicanthium annulatum* Stapf., *D. caricosum* A. Cam., *Dopatrium junceum* B-Ham., *Eclipta alba* Hassk., *Epaltes divaricata* Cass., *Eragrostis gangetica* Steud., *E. unioloides* Nees., *Eriocaulon quinquangulare* L., *E. Sieboldianum* S. & L., *Fimbristylis bisumbellata* Bub., *F. miliacea* Vahl., *Glossostigma spathulatum* Arn., *Gnaphalium indicum* DC., *Grangea maderaspatana* Poir., *Imperata cylindrica* Beauv., *Isachne dispar* Trin., *Leersia hexandra* Sw., *Lindernia parviflora* (Roxb.) Haines, *L. hyssopioides* (Bth.) Haines., *Lippia nodiflora* Mich., *Lobelia trigona* Roxb., *Ludwigia parviflora* Roxb., *Nasturium indicum* DC., *Panicum repens*

L., *Paspalidium germinatum* Stapf., *Rotala densiflora* Koehne, *R. illecebroides* Koehne, *R. leptopetala* Koehne, *R. verticillaris* L., *Saccolepis indica* Chase., *Scleria tassellata* Willd., *Sonchus arvensis* L., *S. oleraceus* L., *Sphaeranthus indicus* L., and *Spilanthes acmella* Mun.

Weeds of Waste Places: *Achyranthes aspera* L., *Ageratum conyzoides* L., *A. mexicana*, *Alternanthera echinata* Smith., *Amarantus gangeticus* L., *A. spinosus* L., *Bothriochloa pertusa* (Willd.) A. Cam., *Apluda aristata* L., *Aristida setacea* Retz., *Barleria buxiflolia* L., *Bidens pilosa* L., *Brachiaria distachya* Stapf., *Calotropis gigantea* R. Br., *Cassia hirsuta* L., *C. occidentalis* L., *Chenopodium ambrosioides* L., *Chloris barbata* Sw., *Cipadessa baccifera* Miw., *Conyza ambigua* DC., *Crotalaria striata* DC., *Croton sparsiflorus* Mor., *Cymbopogon caesius* Stapf., *Cynoglossum furcatum* Wall., *Dactyloctenium aegyptium* Beauv., *Dodonaea viscosa* L., *Eleusine indica* Gaertn., *Eragrostis tenuifolia* Hochst., *Erechthites valerianifolia* DC., *Galinsoga parviflora* Cav., *Heliotropium indicum* L., *Heteropogon contortus* Beauv., *Hyptis suaveolens* Poit., *Ipomaea hederacea* Jacq., *I. obscura* K. Gawl., *Iseilema laxum* Hack., *Jatropha glandulifera* Roxb., *Lantana aculeata* L., *Lepidium sativum* L., *Malvastrum coromandelianum* Garcke, *Mimosa pudica* L., *Opuntia Dillenii* Haw., *Oxalis carniculata* L., *Plectronia parviflora* Bedd., *Portulaca oleracea* L., *Quamoclit phoenicea* Choisy., *Setaria pallidifusca* Stapf. & Hubb., *Sida spinosa* L., *Solanum xanthocarpum* Sch. & Wendl., *Sporobolus diander* Beauv., *Stachytarpheta indica* Vahl., *Stylosanthes mucronata* Willd., *Synedrella nodiflora* Gaertn., *Tephrosia purpurea* Pers., *Themeda triandra* Forsk., *Toddalia asiatica* Lam., *Trianthema decandra* L., *Tribulus terrestris* L., *Triumfetta rhomboidea* Jacq., *Tylophora asthmatica* W. & A., *Urena lobata* L., *Vernonia cinerea* Lees., and *Waltheria indica* L.

Pasture Weeds: *Alysicarpus monilifer* DC., *Boerhaavia diffusa* L., *Desmodium triflorum* DC., *Glossocardia Bosvillea* DC., *Glossogyne pinnatifeda* DC., *Indigofera enneaphylla* L., *Polyzygous tuberosus* Dalz., *Tragus biflorus* Schult., and *Zornia diphylla* Pers.

Poisonous Weeds: *Datura fastusa* L., *Jatropha curcas* L., *Lochnera pusilla* K. Schum., and *Withania somnifera* Dun.

MORE EFFECTIVE USE OF FERTILIZERS

By S. V. Govindarajan, *Agricultural Chemist*

The fertility of soils are controlled among other factors by the available supply of various plant food elements. Applications of manures and fertilizers which supply these elements are necessary for maintaining and also for increasing this fertility. Crops remove from soils numerous mineral elements of which nitrogen, phosphorus and potash are the most important and as they are usually present in limited quantity, the return of these to the soil has to be ensured by application of adequate quantities of manures.

Compared to organic manures like farmyard manure, composts, oil cakes, etc., fertilizers which are chiefly of a mineral nature contain plant food elements in higher concentrations and also in more readily available forms. As such crops give more ready and rapid response to fertilizer treatments than to manure applications. The increasing realization by our ryots of the value of fertilizers for producing larger and better yields of crops has helped to establish a large and ever-increasing demand for fertilizers.

Fertilizer treatments, like other agricultural operations, to be most effective and productive of best results have to be made in proper time and in proper manner, and this apart from applications of the optimum dosages. The need for an efficient use of these materials is also great, since at the present day their supply is limited and their cost high. Only the correct practices based on scientific experiments can ensure that the best returns are obtained out of the plant food contents of fertilizers.

The results of recent experiments in our Government farms indicate that dosage is not the only factor which gives the best yield from a fertilizer application, but that for a given dosage especially of nitrogenous and phosphatic fertilizers, the time and the method of their application to a growing crop are important factors. Compared to the prevailing practices of fertilizer applications, the following practices are found to be improvements and definitely superior in their effectiveness, and as such they are recommended for popular adoption.

1. Efficient Use of Phosphatic Fertilizers

The effectiveness of phosphates to a cereal crop like paddy is enhanced when the phosphatic fertilizers are applied to leguminous crops which are grown and used as green manures to the succeeding cereal crop. Experiments conducted during recent years indicate that

applications of superphosphate or bonemeal at ½ to 1 cwt. to the acre increase the green matter yield of groundnuts, sunhemp and dhanicha by 20-50 per cent. and that the use of these as green manure to paddy without further applications of phosphatic fertilizers give superior crop yields than treatments involving applications of same dose of phosphates directly to the paddy crop. The improved practices yield 20-30 per cent. more yield of crop and hence are definitely advantageous.

2. Optimum Time of Application of Nitrogenous Fertilizers to Paddy

It is now known that nitrogenous fertilizers applied to puddled soil at the time of transplanting paddy are largely lost to the crop for various reasons. In the practice as at present followed, of applying these fertilizers at the time of planting, there is considerable probability that the full use is not made by the growing crop of the plant foods supplied. Delayed application of these materials till after the plant has established itself and after conditions in the soil have become more favourable for such applications, can thus be expected to give better benefit to the crop. Experiments show that the optimum time for application of ammonium sulphate to paddy is 4 to 6 weeks after transplantation and that this practice gives more yield of paddy than application of the same dosage of fertilizer at transplantation time.

3. Placement of Phosphatic Fertilizers

Phosphates suffer from the disadvantage that this plant food cannot move down through soil as easily as or as far as the nitrogenous materials and also that they are rendered insoluble by reaction with various soil minerals. Application of these fertilizers to soil results in their being made insoluble even in the vicinity of their application and unavailable to plant roots excepting those in close proximity to the area of the application. As such the usual practice of broadcasting phosphatic fertilizers suffers from the serious disadvantage that the plant foods may not become available to a large part of the root system of even the shallow rooted crops like cereals. A way to get over these handicaps is to place the phosphates below soil surface, approximately at the depths where the plant roots are concentrated, either before the seeds are sown, or the plants transplanted or in some cases after the crop has come up. The advantage of these methods were well established during the war period in the Western countries where the "Placement" method was found to give large increases in crop yields and also result in economy in the materials used, since in many cases it was found that a fraction of the fertilizer placed at proper depth gave as much yield as the full dose applied at surface. While experiments are in progress to try out the placement methods on a variety of our crops under irrigated and rainfed conditions, it has been found that

placement of the fertilizers 3"-6" below the rows in transplanted ragi gives 20 to 30 per cent. more yield of grain and straw. A conveient method of application is to drill the usual dosage of phosphates ($\frac{1}{2}$ cwt. superphosphate or bonemeal) through a *sadde* attached to a plough and to plant the ragi seedlings in the furrows thus made. The above improved method can thus be adopted with great advantage by our ryots for this crop without great difficulty or any large variation in the present cultural practices.

PLANT SANITATION AS AN AID TO PLANT PROTECTION

By S. V. Venkatarayan, *Plant Pathologist*

The importance of sanitation in human and animal welfare is recognized, but its role in plant diseases or crop welfare is not properly understood. That there are diseases of plants may be easily admitted, but their real causes and methods of prevention are not generally known. Prevention is better than cure, and sanitation provides conditions to promote the welfare of plants. Many plant diseases are caused by parasitic fungi, bacteria or viruses. Sanitary conditions should aim at reducing the sources of infection. Sanitary measures comprise:

1. The use of seeds, cuttings, etc., only from healthy plants.
2. Removal of diseased portions, and disposal of infective material.
3. Sterilization of infected soil.
4. Disinfection of tools, implements, and hands of workers.
5. Disinfection of seeds, cuttings, etc.
6. Rotation of crops.
7. Good environment.

The use of healthy seeds, cuttings, etc.—Fungi and bacteria parasitic on plants reproduce themselves by minute spores adhering to the surface of seeds or other plant parts. Smut on jola is propagated by spores adhering to the grain during threshing of infected earheads. Seed setts from ring-diseased potatoes and cuttings from red-rot infected, smut-infected or mosaic-infected sugarcane invariably give rise to diseased plants.

Removal of diseased portions and disposal of infective material.—Plants or plant parts killed by a disease are a source of danger. To prevent areca *koleroga* (*Phytophthora arecae*) all diseased and dead bunches should be removed from the trees and ground and burnt before the monsoon. Likewise the tops of dead trees should be cut and removed from the garden and burnt. Weeds in the garden that are liable to be infected by the fungus like Bryophyllum, Jatropha, and *Kesavu* (*Colocasia*) should be removed. Coffee leaves infected by rust and black rot, and grapevine leaves infected by rust and downy mildew are sources of infection during the succeeding year, and hence should be buried deep. Cotton and togari (*Cajanus cajan*) stalks should be burnt if the crop is affected by wilt, and so also potatoes

affected by ring disease and early blight. Smutted sugarcane and mosaic-affected sugarcane should be pulled out and destroyed, and taking a ratoon crop should be avoided in an infected plot.

Wound parasites get access to the hosts by wounds caused in pruning or by breaking of branches by the wind. In such cases a clean cut close to the main stem should be made and the wound protected with coal tar, white lead or other protective paint.

Fresh farmyard manure would carry the spores of parasitic fungi, as the digestive juices of animals do not act on the spores. Smut of jola and club-root of cabbage are transmitted in this manner. Under composed compost and mulch have the same drawback.

Sterilisation of infected soil is accomplished by hot water, steam or electrical methods, and is suitable for glass-house crops and small seed plots. It is costly under Indian conditions, and not capable of wide application. Soil in seed-beds can be sterilized by burning trash in tobacco seed-beds some days before sowing. Sterilization with chemicals like lime and sulphur is practicable. In Mysore application of sulphur dust to the soil around *anabe-roga* affected areca and coconut palms (infection by *Ganoderma lucidum*) has been found to be beneficial.

Disinfection of tools, hands, etc.—The cutting-knife used to cut potato tubers transmits the bacteria causing the disease to healthy tubers cut with the same knife. In such a case, the knife should be dipped in hot water or mercuric chloride solution 1 : 1000 parts water, or a relay of knives maintained. Tobacco mosaic disease is transmitted by a mere touch of healthy plants after handling infected plants or tobacco trash or cigarettes, *beedies*, snuff or tobacco in any form obtained from infected plants. Workers should be advised to avoid chewing, smoking or snuffing before and during thinning and transplanting. After handling mosaic plants the hands should be washed clean with soft soap or with 4 per cent. formalin. Tools may be sterilized with the same strength of formalin.

Disinfection of seeds and cuttings.—The earliest method of seed treatment adopted in Mysore was the copper sulphate steep against jola smut. The method was so effective that it was immediately adopted. The strength of solution used was 1 per cent., or 1 lb. in 10 gallons of water, the seed to be soaked for 15 minutes and dried before sowing. If the seed was to be stored, the bags were similarly treated. Packets containing 2 oz. each of copper sulphate were made and sold at cost price in all the agricultural depots in the districts. Each packet would suffice for treating seed for two to three acres. There was a little suppression of germination.

With the adoption of the copper carbonate treatment for wheat bunt, the superiority of dust treatment over liquid steeps became

obvious. For treating jola seed against smut, sulphur dust of 200-300 mesh fineness was employed at the rate of 2-3 oz. for 60 lb. of seed and proved effective.

During the first world war, owing to the scarcity of copper, organic mercury preparations came to be largely employed for seed treatment. Of these ceresan became popular, and recently Agrosan G.N. has been found to be effective against paddy and ragi diseases.

During the second world war, the dearth of mercury induced a search for other chemicals. Organic fungicides have become popular in America. Chief among these are Fermate, Arasan, Nomersan, Spergon or Chloranil, and Phygon. Arasan, Spergon and Phygon have been found useful against jola smut in America.

The fungicide dusts protect the seed with a fine film of dust particles. The fungicide becomes active when the seed is sown in moist soil. The moisture and organic acids present in the soil slowly dissolve the fungicide. This solution prevents the germination of fungus spores adhering to the seed or present in the soil, and also protects the growing seedling from attack by soil fungi. This treatment does not prevent infection by fungi present within the seed as in the loose smut of wheat.

The treatment is simple and almost fool-proof. An overdose is rare, as the excess dust will not adhere to the seed. There is no germination injury as in liquid steeps, and many dusts protect the seed against insect and rodent attack. Seed may be treated and stored for three months or more if it shows good germination and is dry. If it is not good or is slightly damp it should be treated only just before sowing.

For dusting small quantities of seed as vegetable or flower seeds the seed may be placed in a glass bottle or tin with a tight lid to about half the capacity, the required amount of dust put in, and the container shaken for about five minutes.

For treating paddy, ragi, jola, etc., on farms, a small hand-operated seed-treating drum is satisfactory. This may be made from a dust-tight box or barrel with a close-fitting lid mounted eccentrically on iron or wooden stays. The inside of the barrel is fitted with baffle plates or a board to ensure proper mixing of the seed during the rotation. The seed is placed in the drum to ½ to 2|3 of its capacity, the required amount of dust added, and the drum rotated for about 10 to 15 minutes at a slow speed. The dust is usually applied at the rate of 2-3 oz. for 60 lb. of seed. When properly dressed no dust will be left behind in the drum. The treated seed may be sown immediately or stored in a gunny bag. Treated seed should never be used for food or fodder as the dusts are highly poisonous. The treatment should be done outdoors, and dust should not be inhaled. A wet cloth

tied over the nose and mouth acts as a sufficient safeguard in the absence of a good dust mask. The organic mercury dusts should not be handled with wet hands, particularly if there are wounds or a broken skin, as they cause blisters. The hands should be washed clean after the treatment. Bags containing treated seed should be shaken out and washed well before being used again for storing food grains.

Planting materials like slips of pineapple, sugarcane setts, and plantain suckers may be dipped in two per cent. Bordeaux mixture (mixture of copper sulphate and lime solutions) to prevent infection by fungi to which they are susceptible.

Rotation of crops.—A rotation of crops prevents the development of parasites living in the soil. The potato ring disease bacterium lives in the soil for at least three years. The fungus causing *togari* wilt and cotton wilt lives in the soil for long periods in the absence of a suitable host plant. In such cases a three-year rotation with a non-susceptible crop reduces the infection.

Seeds of parasitic plants like those of Striga on jola, sugarcane, etc., and Orobanche on tobacco are known to live in the soil for several years, and the only way to get rid of the infection is by growing a resistant variety or by growing a non-susceptible crop.

Cropping large areas with a single crop is very favourable for the spread of epiphytotics. A mixed crop suffers less from disease than a pure crop, as the majority of plant parasites can live on only one or a few species or varieties of plants. Wheat sown as a mixture in bengal-gram suffers less from rust, and the bengal-gram suffers less from wilt than either of these crops do when grown pure. In Uttar Pradesh wilt of *togari* is known to be reduced when the crop is grown mixed with jola (sorghum).

The environmental factors of moisture, food, temperature, and light favour many diseases. Moisture and temperature aid fungi like smuts. Powdery mildew is abundant in shady situations. Though it is not possible to control Nature, much may be done by controlling irrigation and providing good drainage. Fruit plants particularly are liable to be affected by excessive moisture in the soil. Nutrition is likewise important. Some manures predispose plants to disease. Excess of nitrogen in the soil predisposes plants to rust and powdery mildew. There are some elements in the soil which plants require only in very minute quantities, and hence they are referred to as trace elements like boron, manganese, copper and zinc. The absence or a deficiency of these elements leads to disease. When manures are lacking or are ill-balanced, not only do the plants suffer directly, but easily fall a prey to other more serious diseases.

HOPPER PEST OF MANGO BLOSSOMS

By Syed Usman, *Asst. Entomologist*

Mango hoppers are the bugs concerned in the destruction of mango flowers. *Idiocerus niveosparsus, I. aktinsoni* and *I. clypealis* are the three species commonly met with; they all occur together and are similar as regards habits, damage done by them, and are easily distinguished by their size and markings. The damage caused by the hoppers is threefold: *First*, by means of their powerful ovipositors, they make slits in the leaf buds or flower spikes to insert their eggs, which results in serious injury, for the slits are numerous and so bend and twist the growing buds, that they fail to attain normal development; *secondly*, a more serious damage results from the enormous numbers of hoppers that emerge and begin to inflict further punctures for the purpose of feeding on the rich sap—in severe attacks as many as a couple of thousands of hoppers may be found clustering on one flower spike, as a result, the blossoms shrivel, turn brown and ultimately fall off; *thirdly*, the bugs also secrete *"honey-dew"*, which falls on the leaves, blossoms and on the ground below in small drops and which facilitates the growth of a black fungus, *"sooty mould"*, that imparts an unhealthy appearance; it is also likely that the *"honey-dew"* falling on the blossoms does some damage to the flowers and probably renders pollination difficult.

Description and Life-History

Adults : Small, head broad, body wedge-shaped, hind legs well-developed; light greenish-brown with black and yellow markings; extremely active and capable of flying and jumping about. The hopper has a tubular sucking mouth-part by means of which it punctures the tender leaves and flower spikes and sucks up the plant sap.

Egg : Small, smooth and whitish; inserted in short and superficial slits made on the tender shoots and flower stalks.

Nymph : Small, wingless, pale yellow with bright red eyes; very active and move about rapidly along the flower spikes and tender shoots, and feed voraciously on the plant sap. The nymph cast skin five times; on the under surface of leaves in affected trees patches of cast skins in large numbers are found side by side.

The mango hopper completes its life-cycle in 26-30 days—Egg: 8-10 days; Nymph: 18-20 days. The breeding season corresponds with the time when the mango trees blossom and the hoppers multiply and are found in enormous numbers in all their stages at that

time of the year; during the other season also they are present, but are only few and found resting in the crevices on the bark of lower branches and tree trunks.

Control Methods : Thorough spraying of the blossoms with "Fish oil Rosin Soap", or, "Hongey oil soap", at the rate of 1 lb. in 8 gallons of water is fairly effective, if carried out as soon as the flower spikes appear, and repeated at intervals of 15-20 days to kill the second and subsequent generations of hoppers.

During the past three years tests made with D.D.T. have yielded encouraging results. The following two brands of D.D.T. have been found to be very effective in the form of a spray for small- and large-scale treatment, the spray material being prepared by mixing 1 lb. of either chemical in 20 gallons of water.

(*i*) DeDe Tane—20 per cent. spray powder—a product of the Murphy Chemical Co., Ltd., England, supplied by Messrs. The Bombay Company, Ltd., Broadway, Madras.

(*ii*) D.D.T. (550)—a Geigy product, supplied by Messrs. The Geigy Insecticides Ltd., Ballard Estate, Bombay. The special qualifications of these insecticides against the hoppers have been found in their capacity to kill out 90 per cent. of the pest in the course of three days after one operation of spraying, and the residual effect of the spray in each case has also been found to be evident for at least one month, since during this period no new infestation by hoppers has been noticed. A preventive spray to cover the under-surfaces of bigger branches and tree-trunks given just before flower buds appear and blossoms open out, a second treatment during the main blossom season, and in the event of rainfall subsequent to the second treatment, a third operation of spraying to check re-infestation by a later generation of hoppers migrating from the untreated neighbourhood, will give the maximum protection against the mango hopper pest. On an average 8-10 gallons of the spray liquid will be required for a big-sized tree, 25-30 ft. high and 35-50 years old. The spraying operation should preferably be done in the early hours on still days. Spraying should be done thoroughly and with a good pressure—from below, above and from the sides—so as to cover the entire blossoms, and at the same time it must be made certain that the spray liquid comes into direct contact with all the insects as far as possible.

MICROBRACON HEBETOR—AN ENEMY OF SOME CROP PESTS

By M. Appanna, *Asst. Entomologist*

Microbracon hebetor—a wasp, is a small, dark-brown insect. The female is slightly larger in size than the male and has a prominent egg-laying tube protruding out of the tip of her abdomen.

It is, habitually, a very effective enemy of the moth (*Corcyra cephalonica*) that infests rice and other cereal grains in storage. Generally, such an insect does not act as an enemy of any moth or other kind of insect pests of any crop in the field. But recent work carried out here, has shown that this wasp can be induced artificially to attack and kill the moth pests of field crops like Avare, Jola and Ragi. This finding is a great advantage that is expected to help us in controlling some serious pests like—1. *Avare* pod-borer (*Adisura atkinsoni*); 2. Jola earhead caterpillar (*Steuachroia elongella*) and 3. Ragi stem-borer (*Sesamia inferens*). The speciality about this wasp-enemy is, that it can be easily bred at a small cost, in large numbers in the laboratory on its own natural food—namely the caterpillar of common moth (*Corcyra cephalonica*) that attacks rice, jola or wheat grains in the store. There are other wasp enemies in nature of the three field crop pests of avare, jola and ragi mentioned above; but it is not possible to breed them in the laboratory and unless any wasp-enemy can be bred in large numbers artificially, the liberation of that enemy in the fields having the particular pests, cannot be made, and without such field liberations, no effective control of any of these field pests, by means of their natural enemies, will ever be possible.

The life-history and development of this useful wasp are interesting.

The parent wasp lays cream-coloured spindle-shaped eggs in the intersegmental places on the external surface of the body of the host larva. (Younger stage host larvæ are only pierced by the ovipositor but successful parasitisation does not take place). The parasite grubs, white in colour, hatch out in about 2 days and attach themselves to the body of the host by their oral end. They feed on the host larva —normally 6 to 8 grubs on a single host—and develop, while the host larva is gradually sapped out and killed. The grubs pupate in small white cocoons 8 to 12 days after they hatch out, the period of development being mainly dependent on temperature. The life-cycle of the parasite extends on an average over a period of 10 to 16 days. The adult parasite lives for a considerably long time—on an average about 10 days.

THE 'SURUL PUCHI' (*LEAF MINER*) OF GROUNDNUT

By G. P. Channabasavanna, *Asst. Entomologist*

Among the various pests that attack groundnut crop in Mysore, the leaf-miner (*Stomopteryx nerteria* Meyr.) is an important one. It is locally known as "*Surul puchi*" on account of the habit of its caterpillar of folding the leaves and living and feeding inside the folded leaves. In addition to groundnut, it also attacks soybean and rarely redgram..

The crop grown under irrigated conditions is more susceptible to this pest than the one grown under rain-fed conditions. All stages of the crop are attacked; and it suffers most, if the pest appears in a severe form, in the flowering and fruiting phases of the crop, whereas the loss sustained is very little or negligible, if the attack occurs towards the end when effective flowering has been completed and the pods have set. In certain years the pest attains a serious form, and if not properly checked, the entire affected crop withers up prematurely resulting in heavy loss to the cultivator.

Description

Adult : It is a very small, dark-brown moth having narrow wings fringed with hairs and with a conspicuous small white dot at the front margin of each upper wing.

Egg : Minute; shining pale green in colour; ovoid and beautifully sculptured.

Larva : The newly-hatched caterpillar is small, long and dull grey in colour with the head end black. The full-grown caterpillar is about ¼" long, moderately stout, smooth with a few scattered short hairs; uniformly pale green in colour with the front and hind ends black.

Pupa : Small, rather stout; yellowish or reddish-brown in colour with the head and thoracic regions thickly covered with minute velvety hairs. It is enclosed in a torpedo-shaped cocoon of silk.

Life-History and Habits

Eggs are laid on the tender portions, usually on the lower surface of leaves. The caterpillar, that hatches out of the egg in about 3 days, wanders about for a short time and then mines into a leaflet, the mined portion after a day or two showing up as a pale yellowish-brown streak or blotch. The plants in a severely infested plot appear as if burnt. After mining for about a week the caterpillar comes out and webs together two or more leaflets and lives under shelter for another 4 days, by which time it is full-grown feeding on the green matter all the while. It now enters the pupal stage in a silken cocoon constructed within the folds of the affected and withered leaves. The

moth emerges after about 4 days. It shuns daylight and usually hides under clods and in the affected groundnut bushes and so a large number of them are seen flying out when an affected plant is disturbed. The entire life-cycle occupies about 3 weeks.

Parasites

This pest has more than one enemy in nature which are seen to attack the pest, and which no doubt, keep it in check to a certain extent.

Control

Hexyclan 7% (a product of Messrs. Noury and Van Der Lande Ltd., Bombay) or Gammexane D·025 (a product of the Imperial Chemical Industries) may be used in the form of dust. As soon as the pest is noticed in the field in the shape of pale brownish blotches on the leaf surface and curling and withering of leaves, the plants should be thoroughly dusted preferably in the mornings on still days with a mixture of any one of the insecticides mentioned above and fine wood ash or chalk powder (1 : 1 parts). This may be repeated after a fortnight, if the pest still persists.

Light traps are very useful and may be employed as the adult moths are attracted to light and may thus be prevented from laying their eggs. Ordinary hurricane lanterns (big-sized) may be used, the lantern being placed in a shallow pan containing kerosined water (water and a few drops of kerosine oil) ; the light traps should be set up during dark nights between 7 and 11 p.m. at intervals of a fortnight, soon after the pest is noticed. One lantern is sufficient for every 1½ to 2 acres of the affected field.

Affected leaves may be regularly removed and put in a tin with small holes (of the size of a small pin head) all round or in a container made of fine wire-mesh; this tin or container is placed on a brick or stone in the centre of a shallow pan having water and a few drops of kerosine oil. Several such pans with the infested leaves may be distributed throughout the affected field, the pans being located in cool places as far as possible. The small wasps (enemies) that emerge out through the holes in the tin search out the pest in the field and attack it, thereby reducing the pest-population. Any healthy caterpillar that may crawl out of the tin are caught in the kerosined water in the pan and get killed, and the adult moths that may emerge inside the tin are prevented from escaping out of the tin, as the holes are too small for them to escape, and thus allowing only parasites to escape and increase in number in the field.

Mixed cropping of groundnut with cereals like ragi and jola may minimise the breeding of the pest, while alternate host plants like soybean and redgram grown side by side with groundnut offer an extensive ground for the pest to multiply on a larger scale.

HINTS ON SAFE PRESERVATION OF SEED AND FOODGRAINS

By D. Seshagiri Rao, *Senior Asst. Entomologist*

Stored grains are subject to deterioration and damage resulting in considerable loss due, mainly, to three natural factors, (1) insect attack, (2) rodents, and (3) excessive moisture. This loss may be eliminated or at least reduced to a minimum by adopting certain simple precautionary measures prior to and during storage. These measures are briefly listed below :—

I. Against Grain-Insects

(1) Store only thoroughly dry grain; freshly harvested grain to be spread out in the sun, in thin layers, till it is quite dry. Proper sun-drying will reduce the moisture-content of the grain to a level at which it will not be attractive to insects.

(2) After sun-drying, mix a small quantity, about 1%, of very fine paddy-husk ash with the grain. This is a good grain-preservative and is prepared easily by burning heaped up piles of dry paddy-husk to white ash, grinding it well and screening it through fine cloth. It should be mixed intimately so that each grain gets a coating on it.

(3) *For seed grains only* : Mix Gammexane D·024 (Food storage dust) well with seed grains in the proportion of 1 oz. of chemical diluted with 20 oz. of fine wood ash or chalk powder to one palla of grain. This treatment should not be done for grains intended for consumption.

(4) The store or godown should be dry, airy and well-lighted. Before moving in fresh grain, cracks and crevices should be sealed with cement or mortar, walls white-washed and floor scrubbed clean.

(5) If the floor is likely to 'sweat' a layer of 'dunnage' *i.e.*, some cheap non-absorbing material like paddy-husk, gunny cloth, date-palm matting, bamboo poles, bricks, etc., to be laid on the floor and grain bags piled over it.

(6) If bags are to be piled in stacks the stacks are to be built 1½ ft. away from the walls, a stack to be not more than 15 bags high, and bags to be arranged in alternate lengthwise and breadthwise rows in each layer.

(7) The floor, walls and exposed surfaces of the stacks to be lightly dusted with 5% D.D.T. or Gammexane D·024; about 8 oz. per 100 sq. ft. of area will suffice.

(8) A narrow band of 5% D.D.T. or Gammexane D·024 about 2" wide and ¼" thick to be laid on the floor all round each stack.

(9) Fresh air and light to be allowed in, by keeping doors and windows fully open during daytime.

(10) The condition of the grain to be examined once a fortnight by drawing small samples with a metal probe. If insect infestation is increasing as can be made out from the insects running about or by the proportion of holed grains, remedial measures mentioned below, are to be promptly undertaken.

(11) *Remedial measures.*—If insect infestation is on the increase, the grain is to be taken out, spread out in the sun, sieved, if possible, through a sieve with suitable meshes to remove weevils and beetles, and re-stored after clearing the store.

(12) A more effective method is Fumigation, *i.e.*, applying a volatile poisonous chemical in measured quantity to the infested grain kept in an air-tight enclosure. Certain lethal gases are soon evolved which kill all stages of all insects in the grain. "Killoptera' (also known as 'chlorosal') is a safe grain-fumigant; 30 lb. per 1,000 c.ft. of space is the required dose. Fumigation should always be done under competent technical supervision.

II. Against Rats

(13) The store to be made rat-proof as far as possible, by having doors and window-shutters in good repair, by closing the mouths of drain pipes with wire mesh covers, by closing the space between roof and walls, and other precautions as will prevent rats from gaining entry and lodging inside the store.

(14) Rat holes found inside the store and its immediate neighbourhood should be systematically 'cyanogassed' once a week, and blocked.

(15) If rats have got amidst grain bags and are doing havoc, trapping and baiting should be resorted to; barium carbonate tablets made by mixing 4 oz. of this chemical with 1 lb. of ragi flour and calcium arsenate mixed in cooked rice are good rat-baits.

III. Against Excessive Moisture

(16) As already indicated, thorough drying of the grain preparatory to storage, a dry and airy store, use of proper dunnage on a moist floor, are also measures that will prevent excessive moisture from affecting the grain. In addition, turning over the bags at intervals, and in wet months, opening the bags and spreading the contents on a dry floor for aeration and rebagging afterwards will greatly help in preventing 'heating' of the grain and its adverse consequences.

887-50 Printed at The Bangalore Press Bangalore City, by G. Srinivasa Rao Superintendent and published Mr. M. Vasudevamurty, Secretary, Mysore Agricultural and Exper mental Union, Bangalore City.